Implementation of DSS 43 and DSS 63 High-Power Transmitters

J. R. Paluka
R. F. Systems Development Section

Progress of installation and test of the DSS 43 and DSS 63 high-power transmitters is traced through procurement, installation, and test of the equipment at DSS 13 to overseas shipment and installation status at DSS 63 as of January 25, 1975. The schedule for this activity is to have the DSS 63 subsystem installed, tested, and transferred to operations for the Viking project by mid-July 1975, and the DSS 43 subsystem operational by mid-October 1975.

I. Introduction

In 1970 a high-power transmitter was installed, tested, and transferred to operations at DSS 14. Plans were then initiated to provide high-power transmitters at each 64-m station. In January 1974 the implementation schedule was accelerated by two years. This required a very intensive effort to complete the design and the procurement, and to provide training and test at Goldstone. Present plans are to install high-power transmitters at DSS 43 and DSS 63 during 1974 and 1975. The schedule for this activity is to have the DSS 63 subsystem installed, tested, and transferred to operations for the Viking project by mid-July 1975, and the DSS 43 subsystem transferred to operations by mid-October 1975.

Procurement of major components for these transmitters was started in late 1972. Delivery of most equipment was made in 1973 and 1974. Some of these components were shipped directly to the overseas stations from vendors; and others, as noted below, were shipped to DSS 13 for testing before overseas shipment.

The high-power transmitter is comprised of four main equipment groups: the control group, the power amplifier group, the coolant group, and the high-voltage (HV) power supply group. Figure 1 is a simplified subsystem block diagram of the control group, the power amplifier group, and the parts of HV power supply group that were tested at DSS 13. The tests for each subsystem were conducted at the assembly level, at the group level, and at the subsystem level. Major components of the DSS 13 tıansmitter were substituted to provide an almost complete transmitter subsystem. The main reason for not testing the motor–generator of the power supply group and the coolant group at DSS 13 was economy. Factory testing was performed on these units before being shipped directly overseas.

II. Testing at DSS 13

Testing of the DSS 63 transmitter was started at DSS 13 in mid-February 1974. Initially the control group was tested using a test fixture to simulate other parts of the transmitter. Figure 2 is the local control console, the main part of the control group. By late March 1974 the group-level testing of the controls was completed and interface testing with the DSS 13 heat exchanger was started. In early April the transformer/rectifier, choke, and crowbar were added to the construction of the subsystem using this test configuration and the DSS 13 motor-generator and coolant group. Both the DSS 63 and the DSS 43 power groups were successfully load-tested into a dc load to a full megawatt for approximately twenty-four hours. This test assured sufficient wattage from the power supply group for either a 100-kW or a 400-kW klystron. In early June 1974 the power amplifier group containing a 100-kW klystron (Varian X-3060) was added to complete the test configuration shown in Fig. 1. During June and the first half of July, subsystem-level tests were performed on the transmitter subsystem. On July 15 dismantling and shipping of the subsystem to DSS 63, near Madrid, Spain, was started. During the testing four personnel from DSS 63 were at JPL and DSS 13 a few weeks for training.

Assembly of the DSS 43 high-power transmitter was started in the manner described above in early August 1974. Again, the same portions of the DSS 13 high-power transmitter were used to substitute for those portions of the subsystem which were shipped directly to DSS 43 from vendors. Four personnel from DSS 43 arrived at DSS 13 in July and remained until December and January to contribute to the testing and to receive intensive on-the-job training. In early December the subsystem was dismantled and shipped to DSS 43.

III. Installation and Testing at DSS 63

Construction of facilities for the high-power transmitter subsystem was started in August 1974. The new facilities at DSS 63 consist mainly of a building to contain the transformer/rectifier, the filter choke, and the control junction box, and a complex of concrete pads for the motor-generator set (1750 HP (1305 kW) and 1300 kVA), the motor control center, the auxiliary heat exchanger, the distilled water replenishing unit, underground water tanks, and miscellaneous circuit breaker housings. Figure 3 is a view of this pad area as it appeared in late January 1975. Of the units described above, the motor-generator set, the motor control center, the auxiliary heat exchanger, one circuit breaker box for the synchronous motor, and the 2000-gallon tank for the water replenishment system are in place. Figure 4 is a view of the transformer/rectifier building construction as it appeared in late January. A portion of the pad area described above is visible in the background. The center of this entire area is approximately 70 meters north of the DSS 63 antenna.

In addition to the installation of units pictured in Figs. 3 and 4, the majority of the transmitter equipment located in the antenna pedestal and the operations building has been installed, and interconnecting control cables have been connected. These units include the local control console (Fig. 2), the remote control console, the crowbar cabinet, the motor-generator controller, the field and focus magnet power supply racks, the high-voltage junction box and high-voltage splice box and all power and control cabling from the pedestal and operations building to the tricone where the power amplifier group will ultimately be located. Prior to the arrival of JPL and Goldstone contractor personnel at DSS 63 in November and December 1974, DSS 63 station personnel had installed and partially tested the heat exchanger of the coolant group, which is located on the antenna alidade.

Interface tests were successfully conducted for the first time between the control group and the alidade heat exchanger in late December 1974. In mid-January 1975 the power amplifier cabinet was raised to the antenna tricone (Figs. 5 and 6), and the cabinet was temporarily installed in the tricone for a period of ten days. During this period water flow tests were successfully conducted between the power amplifier cabinet and the alidade heat exchanger for the first time. The purpose of these flow tests was to verify that the heat exchanger can provide sufficient coolant water to the klystron and water load at all elevation angles of the antenna. These tests ensured that a sufficient flow of cooling water is available to the power amplifier cabinet for either a 100-kW or a 400-kW klystron.

The other purpose of temporarily installing the power amplifier cabinet was to assure that the mechanical interface of the cabinet waveguide output port would properly align with the DSS 63 microwave subsystem when the cabinet was bolted in its pre-assigned location. This test was also successfully completed and the cabinet was removed from the tricone and reinstalled in the antenna pedestal to allow continuation of assembly level and group testing when installation of the power supply group is completed. Scheduled beneficial occupancy dates (BOD) were November 1, 1974 for the pad area (Fig. 3) and January 15, 1975 for the transformer/rectifier building. Scheduled completion date (transfer to operations) for the DSS 63 high-power transmitter presently is July 15, 1975.

IV. Installation at DSS 43

Most of the transmitter subsystem has been shipped to DSS 43. To date the main heat exchanger has been installed on the antenna alidade, and selection of a facilities contractor has begun. October 15, 1975 is the scheduled date for transfer of the DSS 43 high-power transmitter to operations.

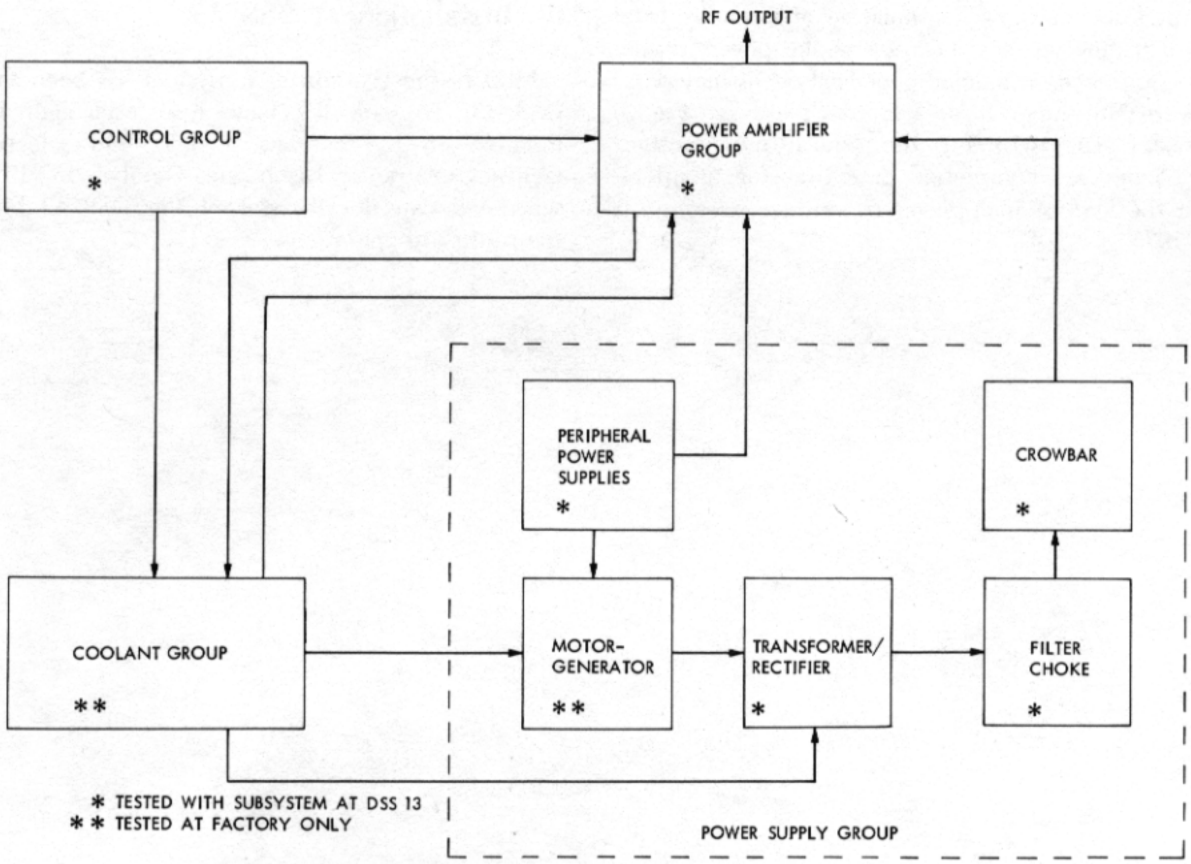

Fig. 1. Subsystem block diagram showing location of preshipment tests

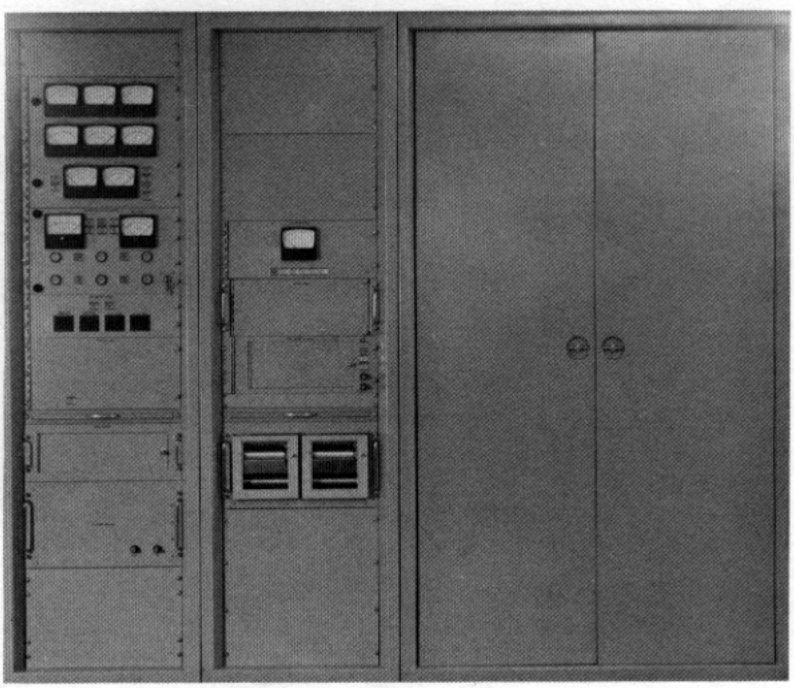

Fig. 2. Local control console

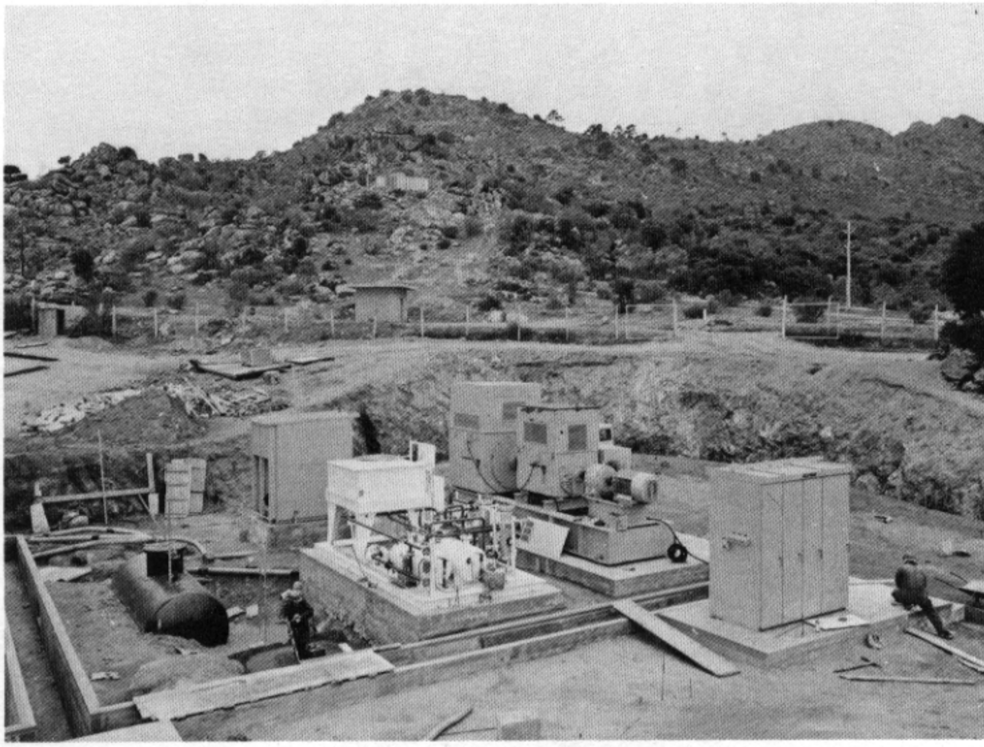

Fig. 3. Facilities status: pad area

Fig. 4. Facilities status: transformer/rectifier area

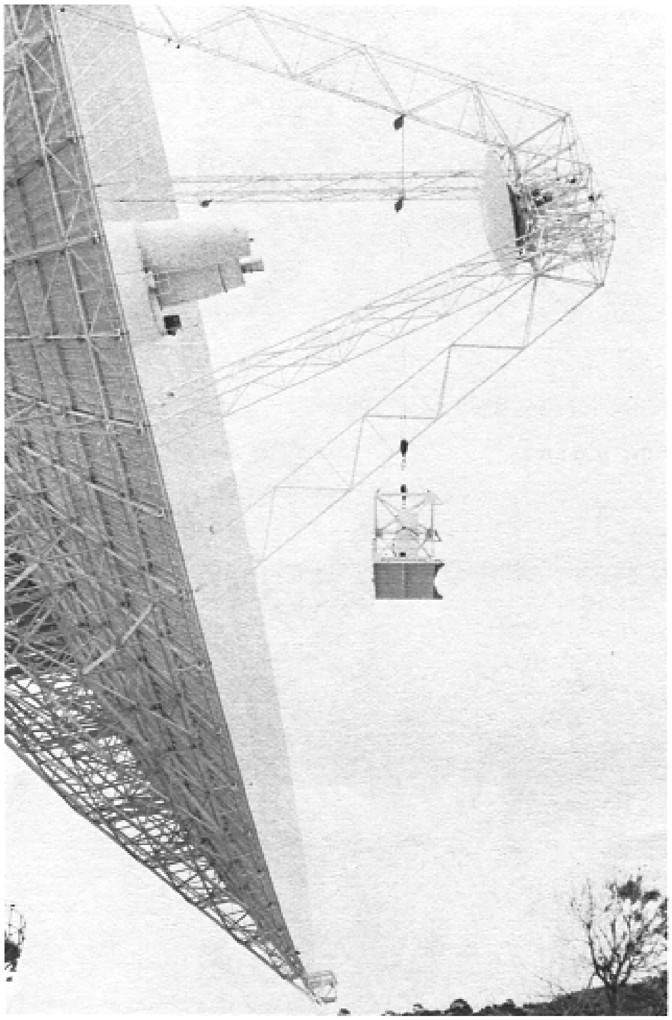

Fig. 5. Power amplifier being raised to antenna surface

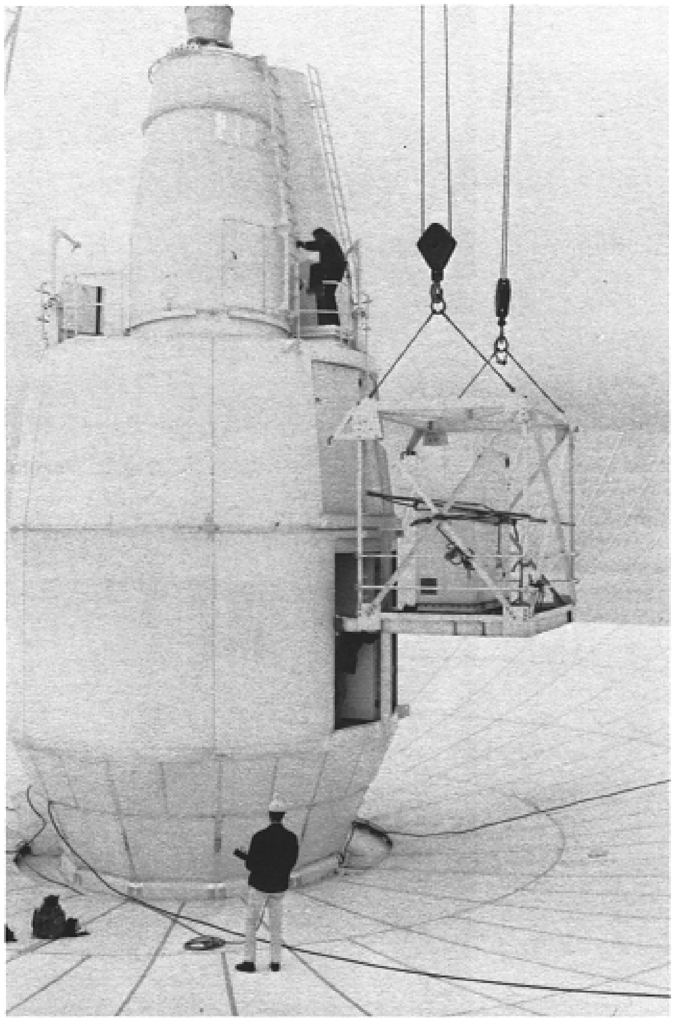

Fig. 6. Power amplifier on back porch being positioned for unloading into tricone